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WATER-RESOURCES INVESTIGATIONS AT KATMAI NATIONAL MONUMENT, ALASKA 1968-69

FINAL

By
Chester Zenone

Prepared in Cooperation with the National Park Service
Administrative Report for U.S. Government Use Only

Water Resources Division
Alaska District
December 1970

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By Chester Zenone

ABSTRACT

Water-resources investigations at several sites at Katmai National Monument were made in 1968 and 1969 by the U.S. Geological Survey. Exploratory drilling at the Park Service Headquarters area on Naknek Lake showed that abundant ground water of acceptable quality is available at depths of less than 20 feet. The nearest easily available water to the Windy Creek Overlook cabin is from springs along a trail into the Valley of Ten Thousand Smokes. At the patrol cabin on Bay of Islands, a shallow well on the beach, or the small tributary to the bay may provide a suitable water supply. Small, fresh-water streams would probably satisfy water demands at proposed Park Service sites at Kukak Bay and at Geographic Harbor. In fact, surface water throughout the Monument could be used for water supply if treated, where necessary, to remove silt or any other undesirable constituents present.

SCOPE AND PURPOSE OF INVESTIGATIONS

The Geological Survey was requested to investigate the availability of ground-water and surface-water supplies at specific sites (fig. 1), to appraise the overall water-resources potential at Katmai National Monument, and to make recommendations for the development of those resources. However, a comprehensive areal water-resources report is not feasible with the expenditure of time, personnel, and finances alloted to the present study. A study program leading to such a report might involve installation of stream-gaging stations, extensive test drilling to evaluate ground-water resources, and measurement of precipitation at several sites. Streamflow

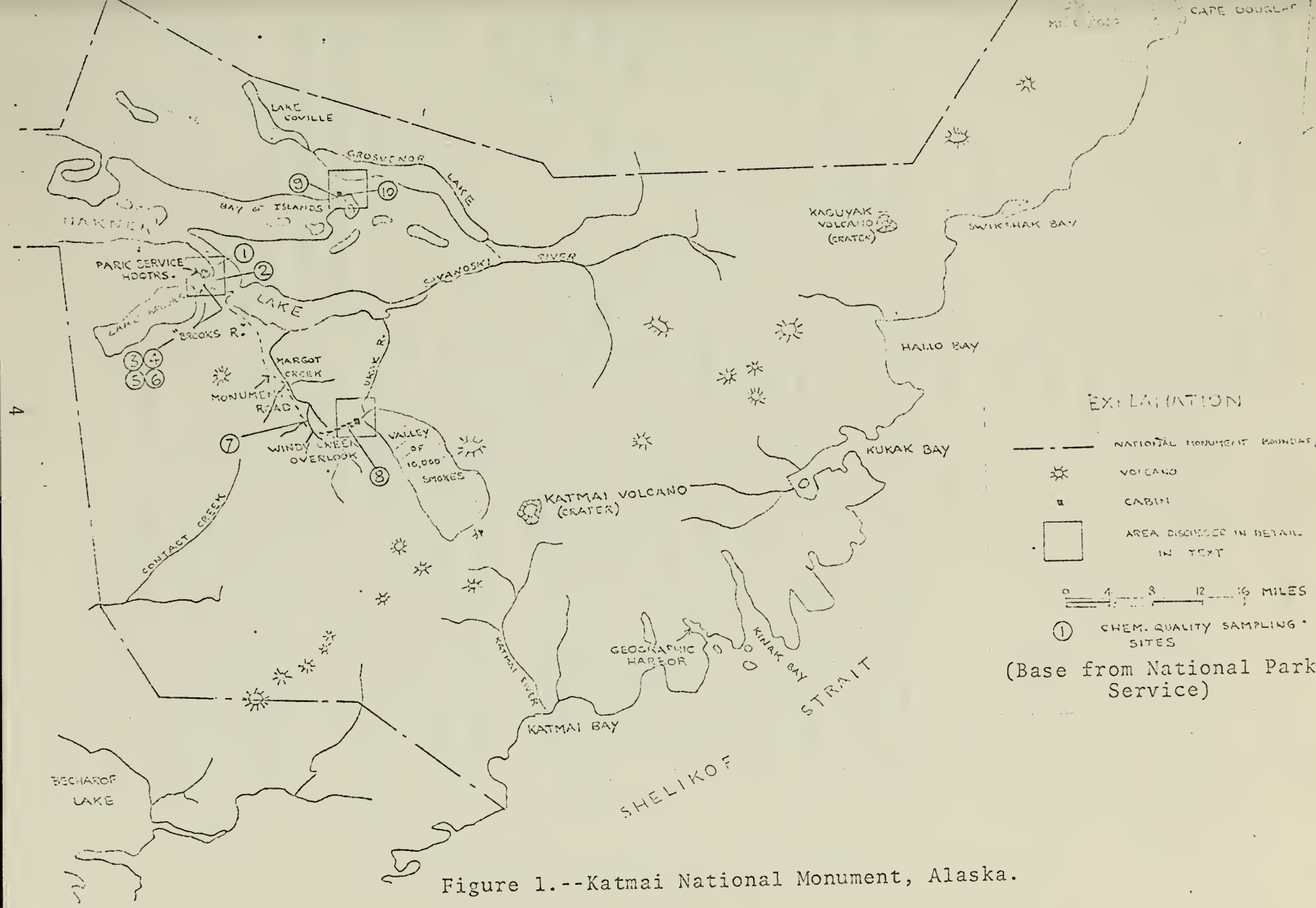


Figure 1.--Katmai National Monument, Alaska.

and precipitation data would require a time base of several years in order to be meaningful.

The present investigations were limited to examination of some of the factors that influence the occurrence of ground water and surface water in three local areas. The hydrogeology of the specific sites is generally understood. However, the complex geology at Katmai National Monument does not permit extension of site data for great distances nor correlation between widely separated data points. Each site presents an isolated water-resource problem.

HYDROGEOLOGIC SETTING

The geology of the Mount Katmai area has been described (Keller and Reiser, 1959) but the rocks have not been examined specifically for their water-bearing properties. The mountainous terrain that makes up much of Katmai National Monument is underlain by sedimentary rocks of Mesozoic age and by younger volcanic rocks. The sandstones and conglomerates in the Mesozoic sequence are potential aquifers (water-bearing rocks). These are interlayered with siltstones, shales, coals, and volcanic rocks, all of which usually have low to negligible water-yielding capacities. The volcanic rocks that locally overlie the Mesozoic rocks in the Monument are also generally poor aquifers except for highly localized water-producing zones.

Both flanks of the Aleutian Range in the Katmai area have been glaciated. Therefore, the lowland areas of the Monument are generally underlain by glacial and fluvial silt, sand, and gravel. These deposits are potential aquifers. Ground-water development would probably be successful in unconsolidated deposits near the streams.

The larger streams in the Monument, such as Savanoski (fig. 1), Ukak, and Katmai Rivers, and Margot Creek, are not likely to provide direct use potable water supplies because of their glacial-silt content. Numerous small tributaries to these streams, and small streams entering the bays and inlets along Shelikof Strait, would probably supply adequate water of acceptable quality.

INDIVIDUAL SITES INVESTIGATED

Park Service Headquarters Area

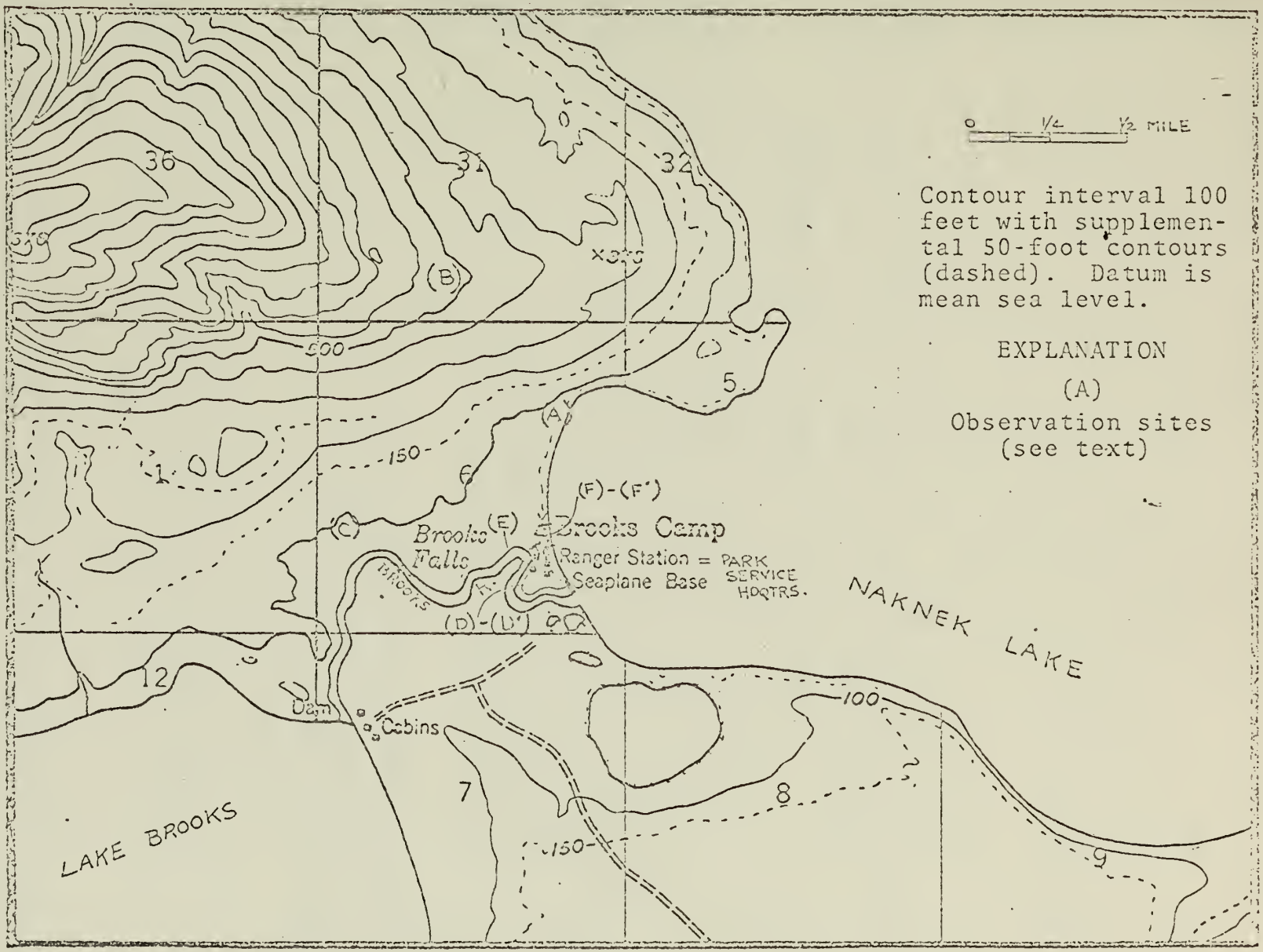
This area was the most intensively studied, because the major development for public use is concentrated at and near the mouth of the stream known locally as Brooks River. Observations on potential water supplies were made at sites designated in figure 2.

A trail between sites (A) and (B) runs through rather dry terrain. The area is underlain by volcanic rocks (Keller and Reiser, 1959), which have only a thin veneer of unconsolidated surficial material. A small water supply might be developed in the spring at one point on the trail. Flow of the spring is approximately 2 gpm (gallons per minute).

Site (C) is in a swampy area; the reddish brown or black color of the water indicates organic matter in solution. This area is unsuitable for development of surface-water or shallow ground-water supplies.

Along the lower reach (D)-(D') of the Brooks River, particularly within 150 yards upstream of the boatdocking area, cutbanks of the river contain mostly sand and gravel overlain by volcanic ash. This area appears the most favorable for a shallow well or gallery installation. Care should be taken to place any such installation upgradient from the pit toilet near the river.

Two test wells were drilled at site (E). Both wells were within 20 feet of the river bank and were approximately 10 feet deep. The materials penetrated in drilling were the same in both wells--1 foot of volcanic ash at the surface and sand and gravel from depths of 1 to 10 feet. Attempts to pump the first well through a 3/4-inch perforated plastic hose were unsuccessful because of mechanical difficulties. The second well, approximately 50 feet downstream from the first, was pumped at 37 gpm through the open end of the 1-1/4-inch drill stem. Pumping was continued for 40 minutes. These results suggest that site (E) would be favorable for the installation of a shallow well or gallery.



Base from U.S. Geological Survey; Mt. Katmai (C-6) quadrangle; 1:63,360

Figure 2.--Park Service Headquarters area, Katmai National Monument.

Test drilling showed that the Naknek Beach area (F)-(F') is underlain by a thin layer of sand, gravel, volcanic ash, and rounded pumice fragments, which is in turn underlain by consolidated material. The consolidated layer is thought to be weathered bedrock that forms the boundary of the glacially deepened basin of Naknek Lake. Bedrock prevented drilling below depths of 9 feet in holes 1 and 3, and below 6 feet and 5 feet in holes 4 and 5, respectively; but it was not present at a depth of 10 feet in holes 2 and 6 (fig. 3).

Some ground water is present above the consolidated material at the edge of Naknek Lake. However, any water intake structure should be placed lower than the lake surface so that recharge from the lake itself would be available.

Monument Road and Windy Creek Overlook

In traveling the Monument road from Park Service Headquarters to the Windy Creek Overlook, some general observations were made regarding water resources and their potential. These are discussed below (mileage is measured from boat dock at mouth of Brooks River and indicated on fig. 3A).

The stream at mile 12.8, like others crossed by the road, is tributary to Margot Creek. The water appeared to be slightly turbid; this would probably not restrict its use as a potable supply.

Between mile 13.3 and 13.4, surface seeps, small runoff channels, and lush vegetation indicate very wet conditions. If a small water source were desired here, a search upgradient might reveal a spring in which the flow is concentrated.

Discharge from a spring crosses the road at mile 16.2, the second ford. The spring water is clear and chemical analysis shows that it is of excellent quality (analysis 8, table 1 and figs. 1 and 3A).

Between mile 21.0 and mile 22.5 several small springs originate in the Windy Creek Overlook area. Flow in the springs ranged from 1 gpm to approximately 5 gpm. In September 1968, D. A. Morris observed no surface flow at any of the springs. However, small seeps and locally greener vegetation suggested underflow at that late-summer period. Subsurface exploration might verify that ground-water development is possible in the area.

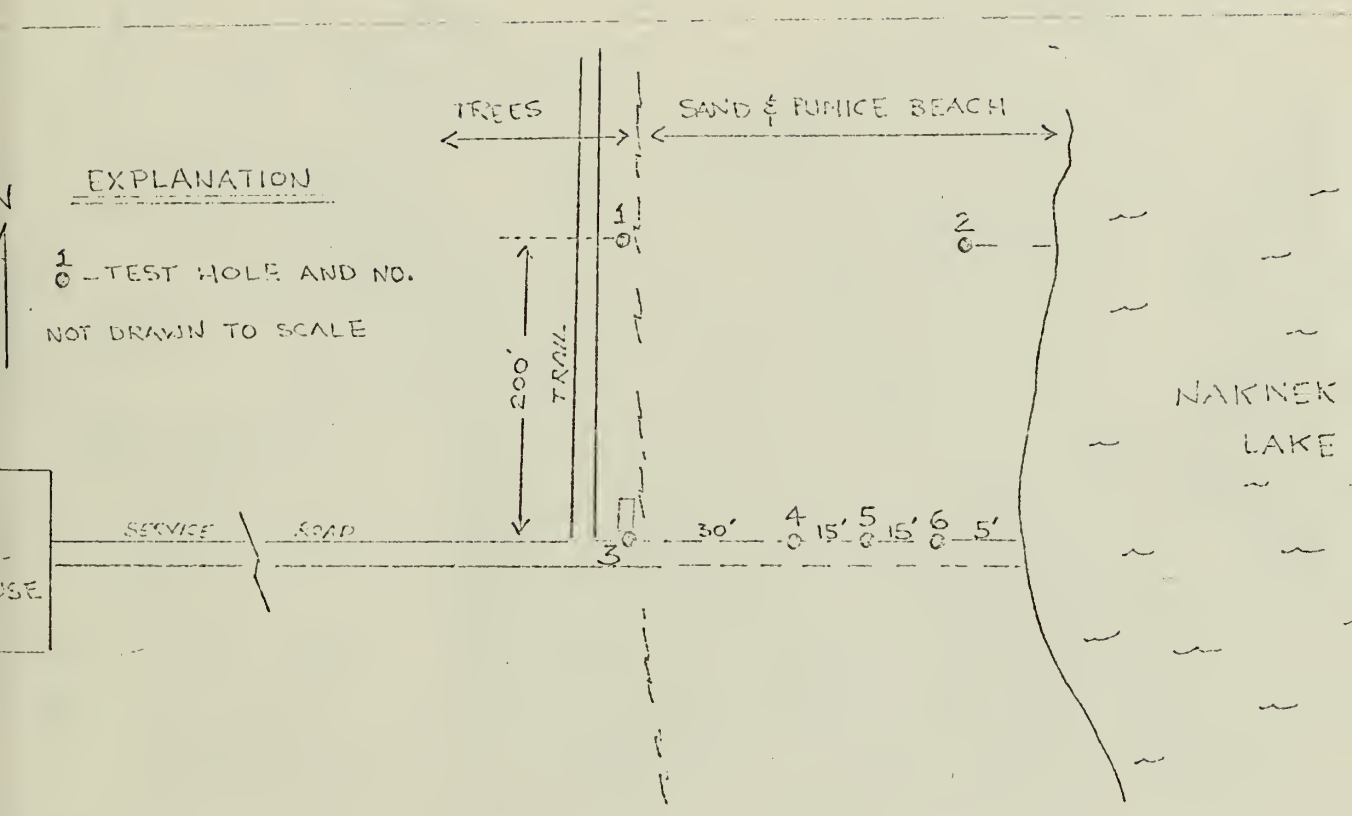
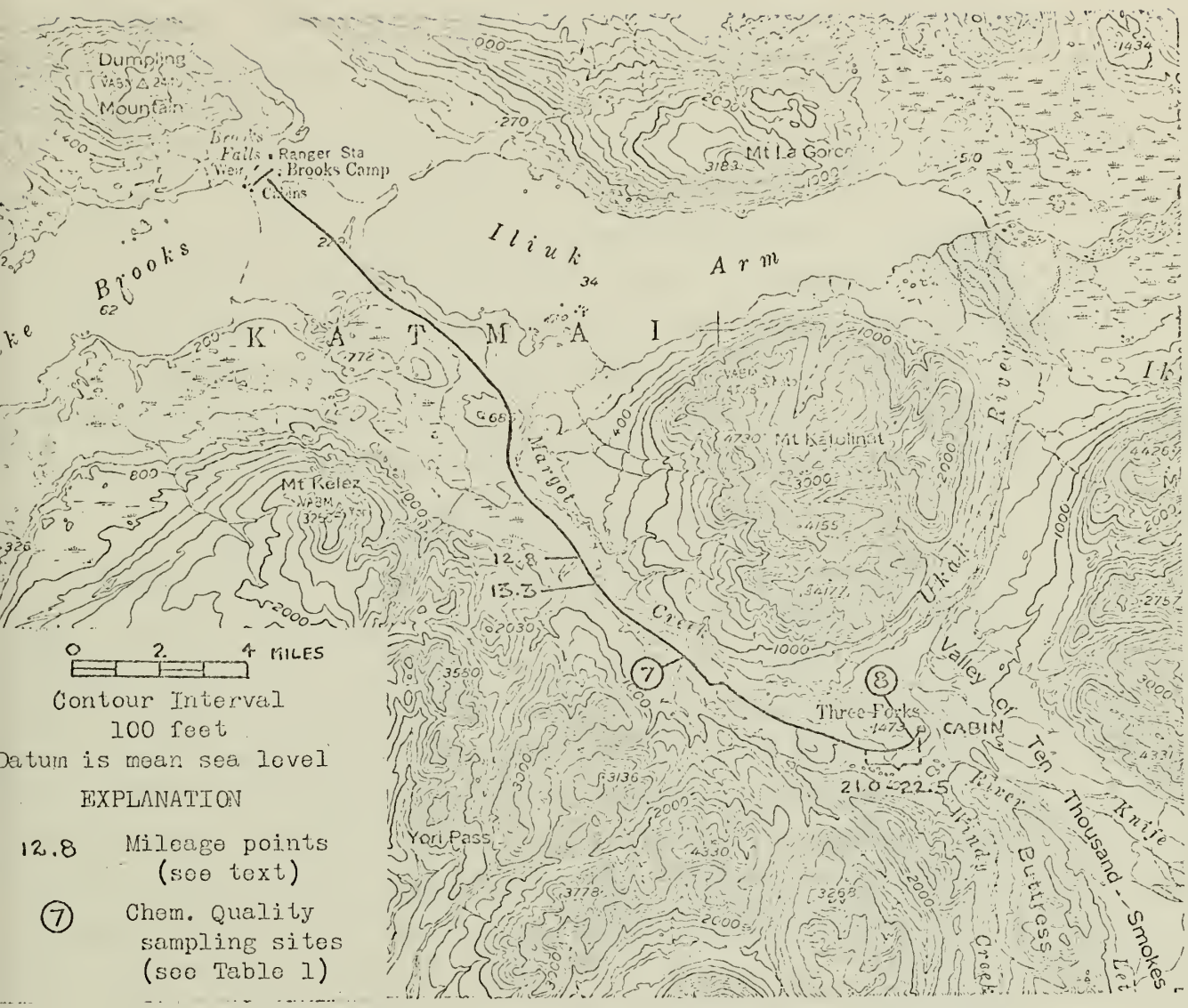


Figure 3.--Schematic diagram of test-hole locations on beach of Naknek Lake (Detail of area (F)-(F') on fig. 2).



(Base from U.S. Geol. Survey; Mt. Katmai, Alaska sheet; 1:250,000)

Figure 3A -- Route of Monument Road from Brooks Camp (Headquarters Area) to the Windy Creek Overlook cabin

The Windy Creek Overlook (fig. 1), at mile 23.0, is on a prominent, isolated high point about 1,400 feet in elevation. Consequently, the only source of ground water would be from locally infiltrated precipitation, which would drain away rapidly. The water would be available near the surface only in areas below the hilltop, such as from the springs observed along the road to the Overlook.

A small depression near the Park Service cabin was dry in September 1968 but supported a small pond fed by melting snow in June 1969. However, drainage from nearby latrines now precludes use of this water as even a temporary supply.

The nearest water to the Overlook point is that observed both in September 1968 and June 1969 at springs about half a mile down the trail into the Valley of Ten Thousand Smokes. The two separate observations suggest year-round flow here.

Bay of Islands Patrol Cabin Area

Along a short reach of the shore east of the cabin (fig. 4), the rocks are stained a deep rust color. Immediately above this reach is a swampy area containing water that, because of its reddish brown color, appears to have a very high organic or iron content. The area below the swamp would probably not provide a potable surface- or ground-water supply. Further east along this shore a small stream, flowing approximately 25 gpm, enters the Bay of Islands. The stream should provide ample water for anticipated use at this site.

A well was drilled in a small sandy area on the beach just below the cabin. Material present was volcanic ash, clay, sand, and gravel from the surface to the 10-foot total depth. Water pumped from this depth was clouded with fine sediment; a properly screened well would probably eliminate this problem.

Base from U.S. Geological Survey; Mt. Katmai (C-5) quadrangle; 1:63,360

Figure 4.--Bay of Islands patrol cabin area.

OTHER PROPOSED DEVELOPMENT AREAS

In September 1968 ground observations were made at the Kukak Bay cannery site (fig. 1). A spring that supplied the now abandoned cannery could probably be developed to supply the needs of the area. A small stream in a sheltered bay south of the cannery appears to be a favorable site for a gallery installation.

During summer 1969, poor weather twice prevented Geological Survey personnel from reaching proposed development sites along the Shelikof Strait coastline. Surface water features--fresh-water streams and springs that flow into the many bays and inlets--were observed from the air. However, interpretations concerning the quantity and quality of that water must await on-site investigations.

QUALITY OF WATER

Chemical analyses of waters from Katmai National Monument are given in table 1 (sampling locations are indicated in figure 1). In 5 of the 6 samples for which iron content was determined, concentrations of iron exceeded the 0.3 mg/l (milligrams per liter) recommended upper limit for drinking water (U.S. Public Health Service, 1962). Sample numbers 4 and 9 contained anomalously high amounts of iron; reanalysis is recommended. The other waters having iron concentrations greater than the 0.3 mg/l limit (sample numbers 2, 5, and 6) would be usable for camp sites if better quality water cannot be found.

The major quality-related problem in using these waters will probably be their corrosiveness. The chemical quality of the water is similar to that of water in other parts of Alaska that has proven to be corrosive in water distribution systems (Heyward, 1969, p. 46).

Nitrate (NO_3)	Dissolved solids (Calculated)	Hardness as $CaCO_3$		Specific conductance (micromhos at 25°C)	pH	Temperature (°C)
		Calcium magnesium	Noncarbonate			
0.1	67	34	7	94	7.7	9.5
0.7	64	35	3	95	7.4	2.5
0	52	30	4	81	7.6	5.5
0.2	62	34	3	94	7.2	7.5
0	61	36	6	92	7.0	3.0
0.4	53	26	3	77	7.4	---
0.1	60	32	12	90	7.5	6.0
0	82	45	11	118	7.4	3.0
0.6	153	84	8	222	7.2	9.5
0.4	78	48	0	127	7.7	9.0

Table 1.--Miscellaneous chemical analyses of the water at Katmai National Monument.
(Collected June 1969)

SAMPLING LOCATIONS (SEE FIGURES 1 & 3A)	Area	Source	Silica (SiO_2) (mg/l)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (Calculated)	Hardness as $CaCO_3$		Specific conductance (micromhos at 25°C)	pH	Temperature (°C)
															Calcium magnesium	Noncarbonate			
①	Brooks Camp-Naknek Lake	Tap in NPS cabin-water from lake	9.6	--	8.3	2.2	4.5	1.0	33	9.6	14*	0.2	0.1	67	34	7	94	7.7	9.5
②	Brooks Camp- "	NCA well nr boat dock	14	.69	9.8	2.6	4.7	1.1	39	6.9	4.0	0.2	0.7	64	35	3	95	7.4	2.5
③	Brooks R at Naknek L	At left bank 400 ft upstr. from lake	10	.05	8.4	2.1	3.8	1.1	32	6.7	3.6	0.1	0	52	30	4	81	7.6	5.5
④	"	Test hole 1	11	4.20**	9.4	2.5	4.2	1.1	38	9.6	4.3	0.3	0.2	62	34	3	94	7.2	7.5
⑤	"	Test hole 2	11	.46	10	2.5	4.2	1.1	37	8.8	4.8	0.2	0	61	36	6	92	7.0	3.0
⑥	"	Test hole 3	12	.39	7.4	1.9	4.0	.9	28	7.1	5.0	0.1	0.4	53	26	3	77	7.4	--
⑦	Valley of 10,000 Smokes above Margot Creek	Spring xing monument road at mi. 16.2	14	--	8.6	1.9	3.7	.7	24	16	2.7	0.2	0.1	60	32	12	90	7.5	6.0
⑧	Windy Cr. Overlook	Spring xing monument rd 0.8 mi. below cabin	18	--	12	3.6	4.9	.6	42	18	3.5	0.3	0	82	45	11	118	7.4	3.0
⑨	Bay of Islands	Test hole on beach at cabin	17	19**	23	6.3	10	2.5	92	21	8.4	0.2	0.6	153	84	8	222	7.2	9.5
⑩	"	small str. entering bay east of cabin	9.8	--	15	2.7	6.3	1.8	64	4.8	5.3	0.3	0.4	78	48	0	127	7.7	9.0

* Chlorinated
** Anomalously high; additional analyses for iron would be desirable

CONCLUSIONS

At the one major development site within Katmai National Monument, the Park Service Headquarters area, water supplies adequate for present and anticipated demands are available from shallow depths near the mouth of Brooks River. At the Windy Creek Overlook area, the only easily available water appears to be from springs about half a mile from the present cabin site. At the Bay of Islands patrol cabin, a shallow well on the beach could probably supply adequate water. At sites on Shelikof Strait water supplies seem assured from surface streams, although further investigations remain to be made.

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